Agora Energiewende

Preparing the necessary phase-out of fossil gas in Europe

Benchmarks and recommendations for the Fit for 55 package

October 2021

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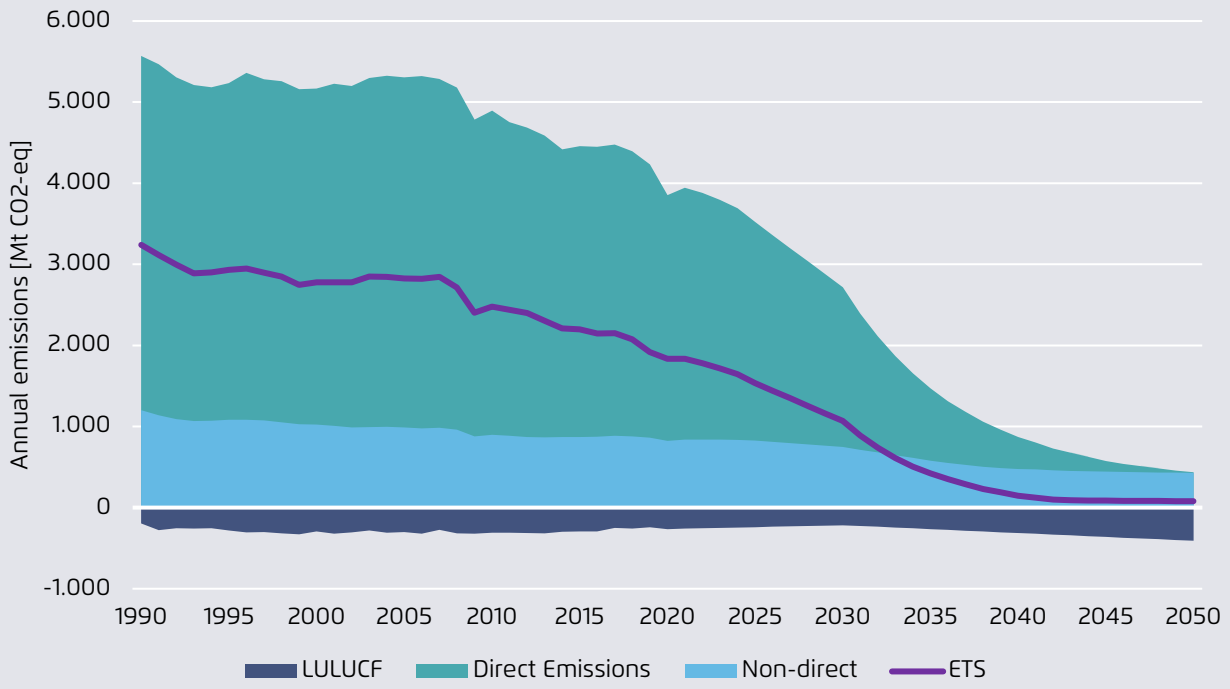
Interim Results of forthcoming Agora Report on “Future of Fossil Gas in Europe”- Overview

Study background: What are the implications of the EU's net-zero 2050 target for fossil gas, and what do they mean for the second part of the Fit-for-55 package?

Annual emission trajectory for EU27+3 (NO, CH, UK) per emission type

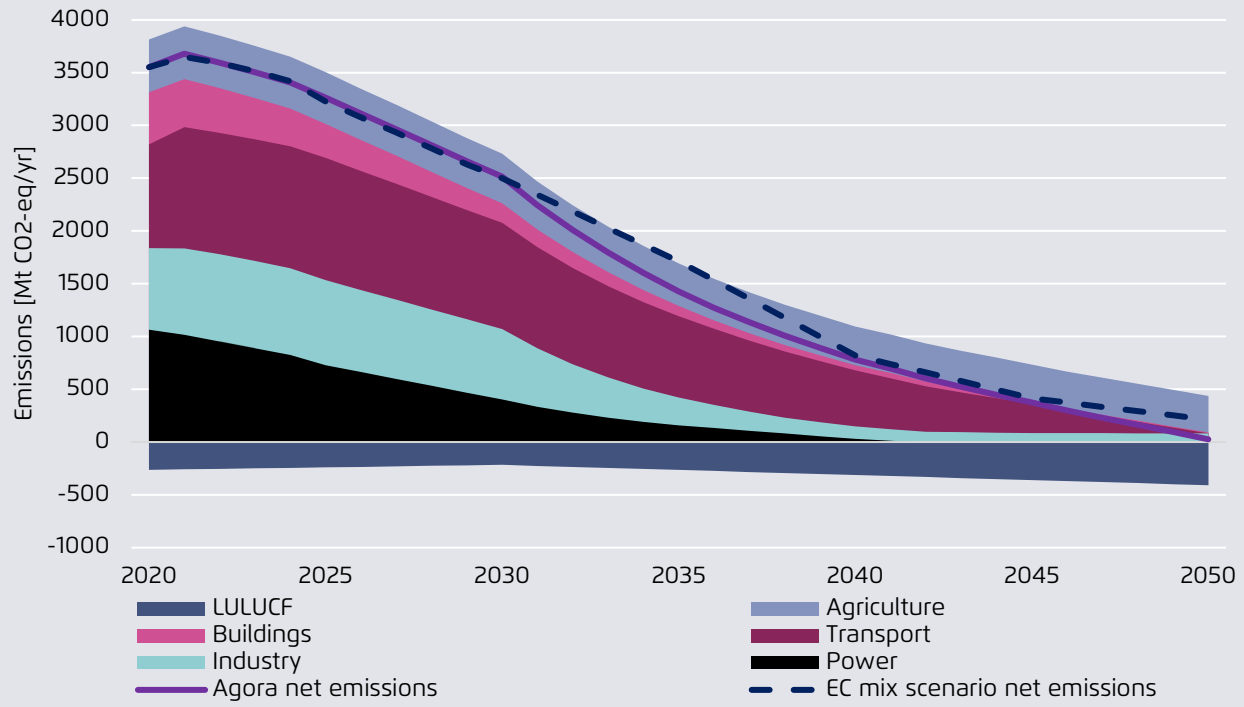


TEP/Artelys/WI

- The European Climate Law sets binding targets to reach climate neutrality by latest 2050 and to reduce net domestic GHG emissions by at least 55% by 2030 compared to 1990 levels. The Climate Law also obliges the EU Commission to set an indicative greenhouse gas emissions budget for 2030-2050 when developing its proposal for the EU's 2040 climate target.
- The -55% target means that coal use in Europe will be phased out almost completely by 2030.
- For 2030-2050, the EU should aim for the steepest possible emission cuts to help limit global temperature increase in line with the Paris Agreement.

The EU should aim for at least 85% GHG-reductions by 2040 to reach climate neutrality by latest 2050. This requires that unabated fossil gas use is largely phased-out by 2040.

Annual emission trajectory for EU27+3 (NO, CH, UK)



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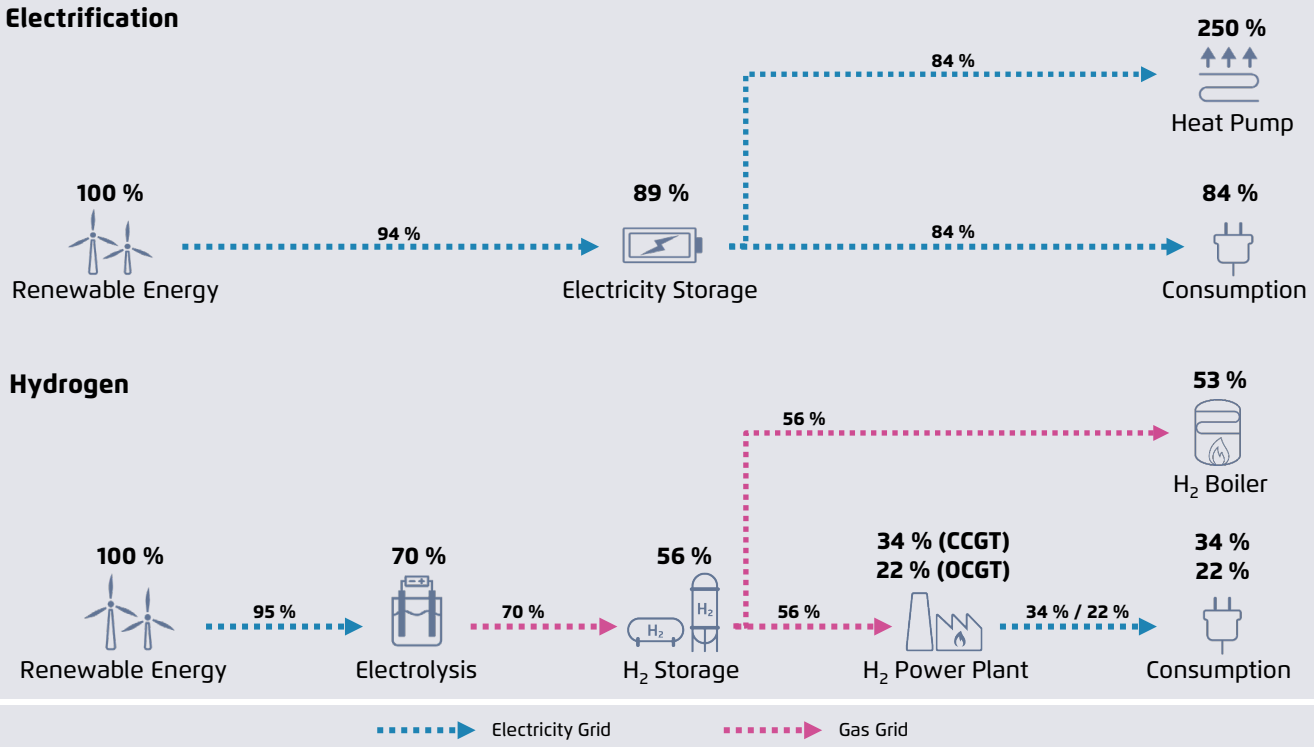
Reducing GHG-emissions by at least 85% by 2040 would correlate with a remaining 2030 to 2050 GHG-budget of less than 20 Gigatons. Staying within this carbon budget requires that:

- Coal is almost completely phased out in the power sector by 2030.
- Unabated fossil gas use is almost completely phased out by 2035 in the power sector and by 2040 in buildings and industry.
- Fossil gas use in the industry sector is reduced by 46% until 2030 and 74% until 2035, compared to 2018.
- Fossil gas use in the building sector is reduced by 58% until 2030 and 83% until 2035, compared to 2020.
- After 2040, fossil gas use should be combined with carbon capture technologies and prevention of methane leakage.

Focusing on electrification saves costs and eases implementation compared to hydrogen.

Efficiency of electrification compared to green hydrogen for heat and electricity



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- Electrification is the most efficient option for decarbonization.
- Gaseous fuels can in some conditions reuse existing infrastructure in industrial appliances and on the transmission level. However, there is a risk of methane leakage with blue hydrogen and with CCS.
- Sustainable biogas and biomethane have limited potential. They can play a role at local level, but methane leakage monitoring and prevention should be put in place as well.
- Hydrogen is expensive to produce and should be used only in sectors where other non emitting technical options do not (yet) exist and in niche applications with clear value added (e.g., power sector balancing, some industrial appliances, hybrid heat pumps).
- Hydrogen should not be blended into fossil gas systems. Industry requires pure hydrogen and blending hydrogen to decarbonize gas grids is costly and inefficient (specifically transmission).

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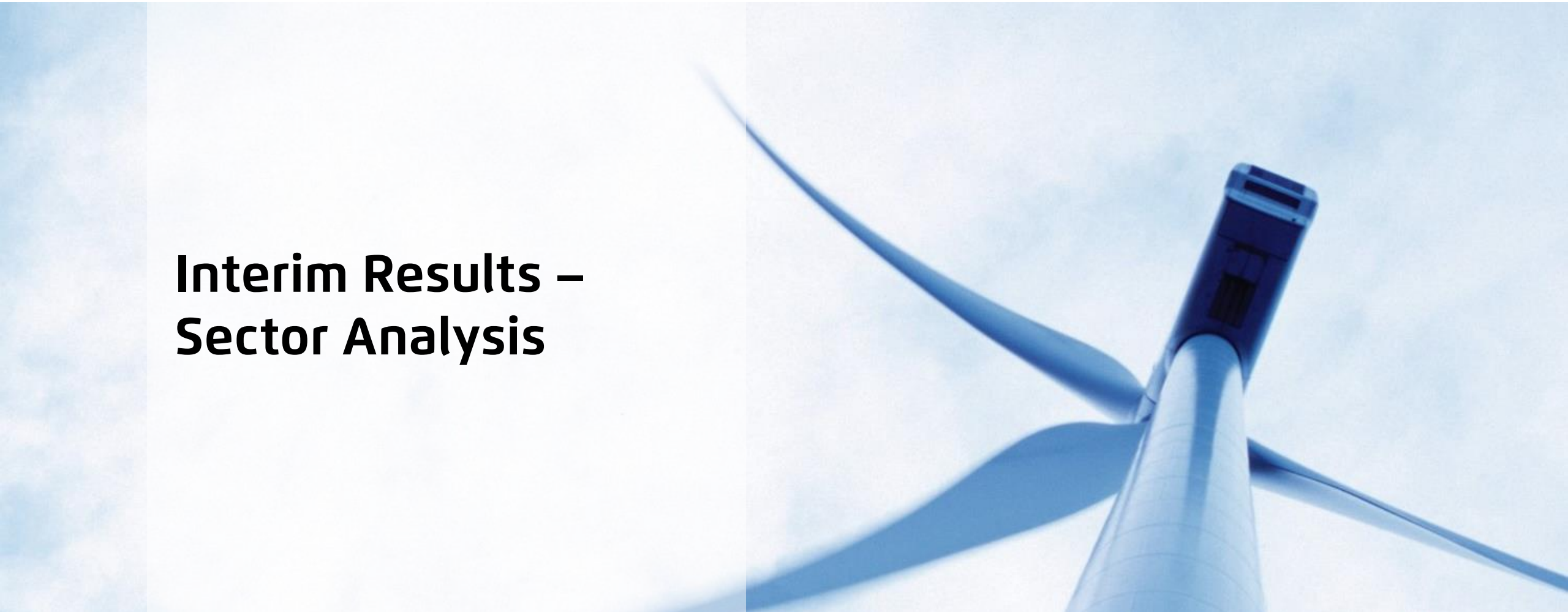

Interim Results – Sector Analysis

In the power sector, fossil gas needs to be largely phased out by 2035. Security of supply will be ensured by RES, hydrogen plants, hydro storage, flexible demand, grids and batteries.

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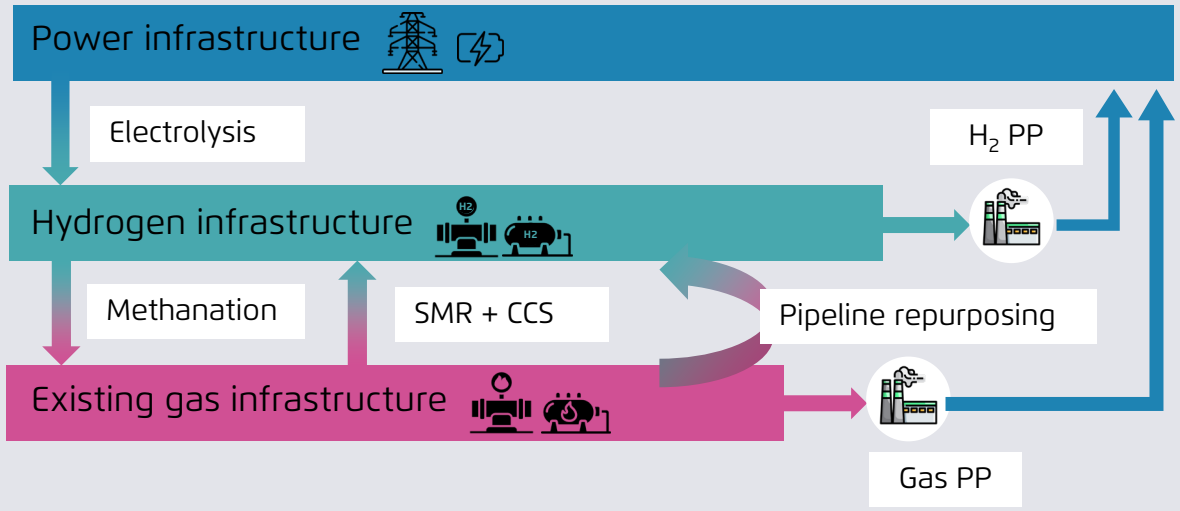
Key interlinkages between energy systems

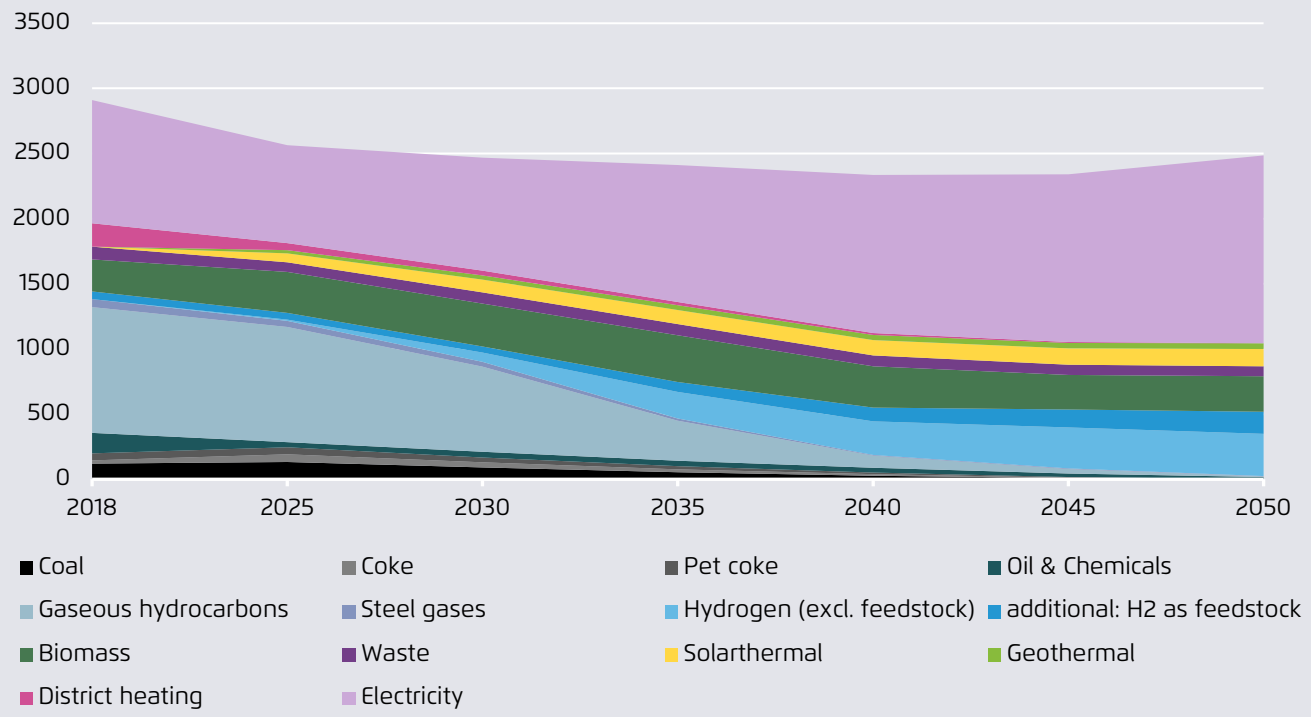


Artelys

- Following the phasing out of coal by 2030, fossil gas needs to be largely phased out by 2035. CCS is not considered a cost-efficient decarbonization option and methane leakage poses large risks.
- Up to 75% of power needed will be produced by wind and solar. Thermal power plants running on biomethane or green hydrogen are candidates to take over the bulk of generation during dark doldrum periods. Fossil gas plants can provide a capacity value for limited hours.
- Flexible assets, such as pumped hydro storage, batteries and electrolysers, enable a cost-effective integration of variable renewables.
- Efficient interconnections between European countries are a key enabler for decarbonisation.
- Parts of the existing gas transmission infra-structure can be repurposed for hydrogen transport by 2050 depending on volumes.

In the industry sector, electric solutions need to replace most fossil gas by 2040. Hydrogen will play a role where electrification is not cost-efficient or technically feasible.

Final energy demand in Industry for EU-27 [TWh, interim results]



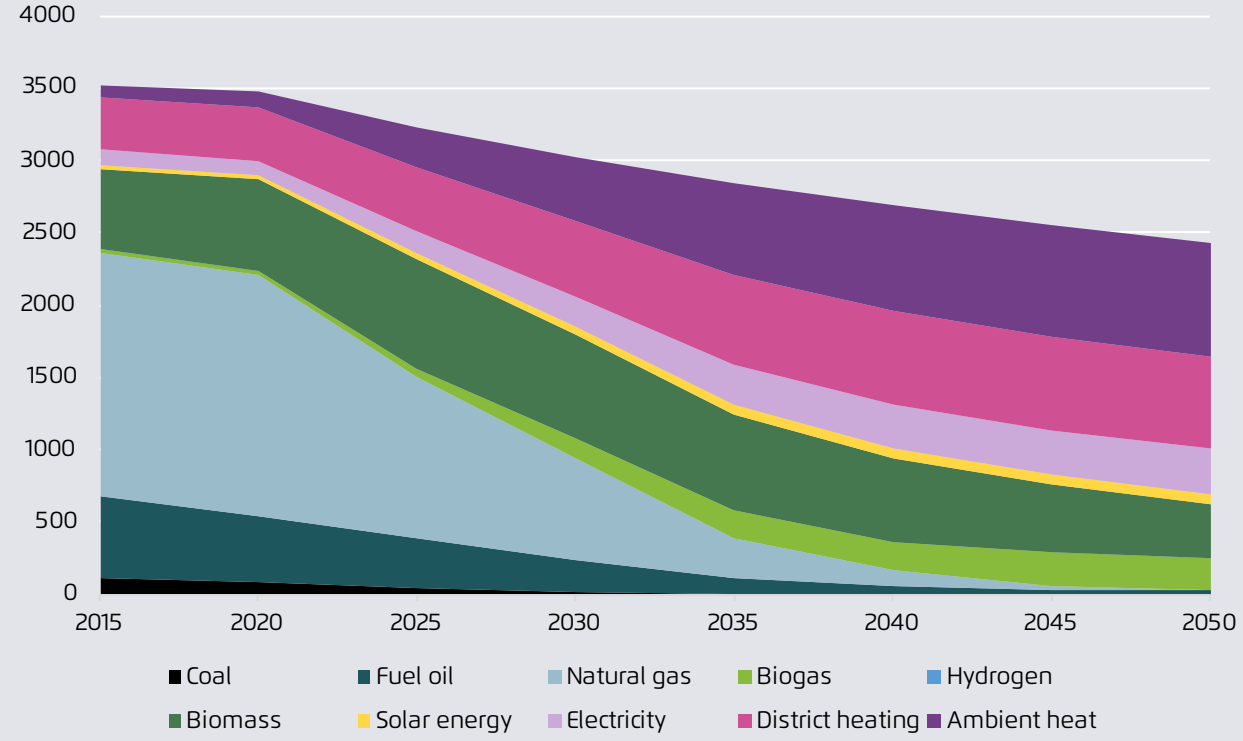
Wuppertal Institute

Fossil gas needs to be strongly reduced in the industry sector by 2040 (including feedstocks).

- → The key technologies to replace fossil gas are: electrification through wind and solar for power; heat pumps, solar thermal and geothermal for low-temperature heat (replacing approx. 40 percent of industrial gas use); and electrification, concentrated solar power, biomass, and hydrogen for higher temperature processes
- → The replacement of non-energy-related use of fossil gas is very much dependent on the actual processes. The most relevant process is steam methane reforming (i.e., the production of grey hydrogen to produce ammonia for example), which can be directly replaced by blue/green hydrogen. A second relevant use category is synthesis gas production ($CO+H_2$), e.g., to produce methanol or phosgene, which requires carbon and hydrogen.

In the building sector, fossil gas needs to be largely phased out by 2040, most of it being replaced through building renovation, heat pumps and district heating.

Final heat energy demand in buildings for EU 27+3 [TWh, interim results]



TEP

Unabated fossil gas use should be largely phased out by 2040, with a full phase-out by 2045. Key elements are:

a. Increasing the renovation depth and renovation rate of buildings to reduce useful energy demand by around 35% by 2050;

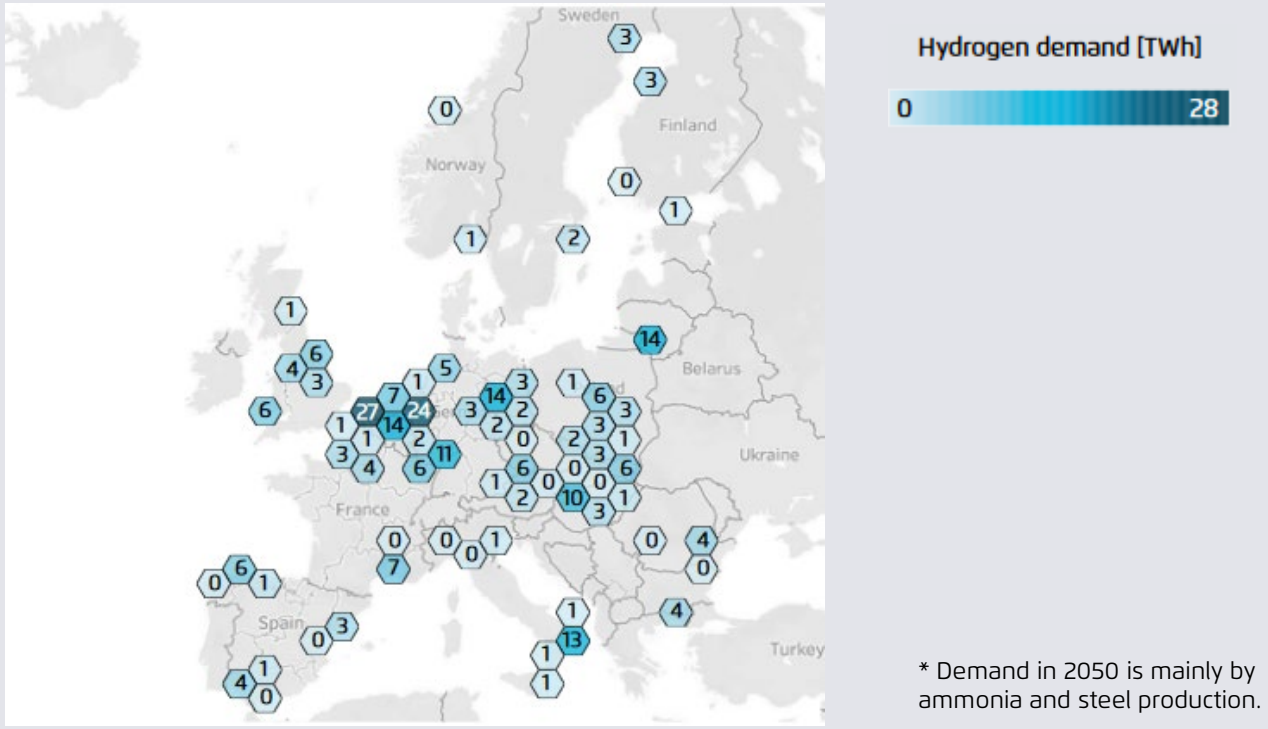
b. replacing fossil heating systems by heat pumps, solar thermal and geothermal systems and supported by favorable energy price ratios (electricity price / gas price < 3);

c. increasing the use of district heating in densely populated areas and ensuring that the systems are supplied by renewable heating solutions (large heat pumps, geothermal heat, waste heat);

d. limiting the use of renewable gases for heating to cases where decentralized systems (e.g., heat pumps) are insufficient as bioenergy is a scarce resource.

Gas distribution grid operators need to prepare for a disruptive change of their business model as hydrogen infrastructure will mainly be anchored around industrial demand.

Distribution of industrial hydrogen demand projected for 2050 [TWh per year]



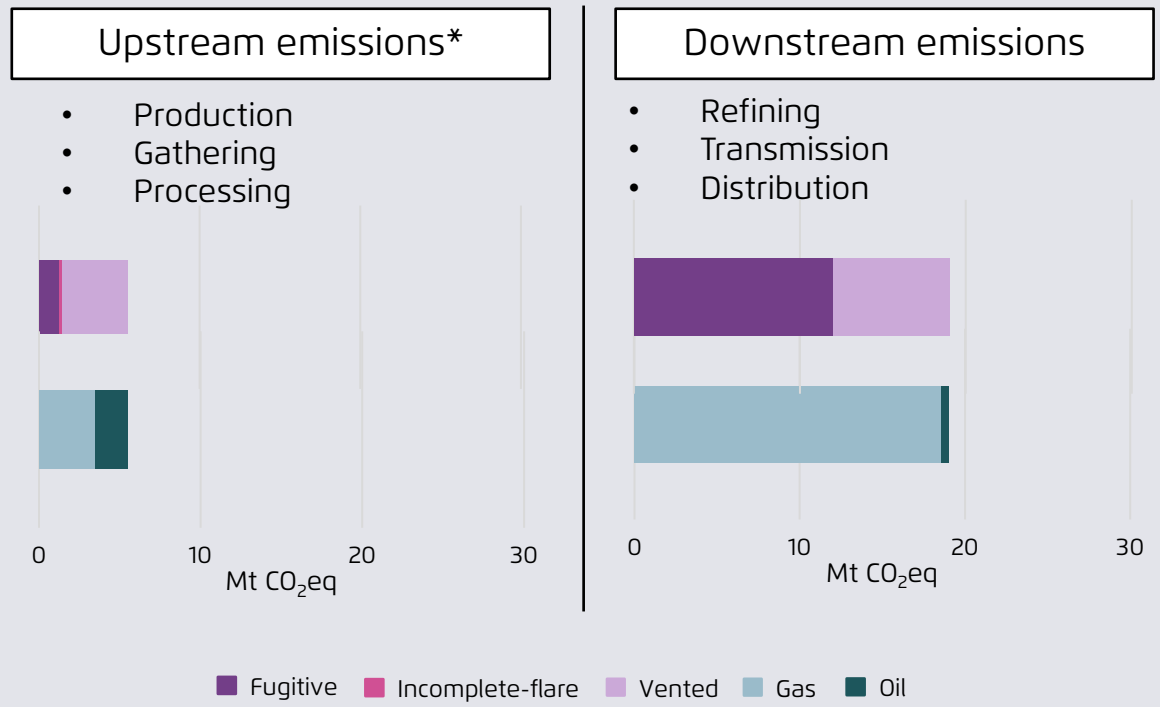
* Demand in 2050 is mainly by ammonia and steel production.

AFRY (2021)

- Hydrogen use and separated infrastructure as well as bioenergy use will be anchored around industrial clusters. Hydrogen volumes will be significantly less compared to current fossil gas volumes. There is no case for blending nor connecting biogas/methane to the gas grid.
- Cross border infrastructure is relevant for certain geographic areas. Certain parts of the gas transmission infrastructure can be repurposed for hydrogen, others need to be dismantled.
- If there is an internal market for hydrogen, it will be significantly different from today's gas market. Some measures may be needed to avoid misuse of market power.
- The building sector will mainly transit towards heat pumps and district heating. Hydrogen will play a very limited role e.g. in district heating during limited peak periods; also bioenergy will need to be used in other sectors.

The EU needs a credible strategy towards methane leakage.

Methane leakage emissions by source and energy in 2020 (EU27 estimate)



IEA, Methane Tracker Database (2021) and own calculations based on IPCC AR6 100-year GWP

- → Methane is the most relevant greenhouse gas after CO_2 and is released in fossil fuel production and use. As largest importer of fossil fuels, the EU must take responsibility to ensure a rapid reduction of methane emission at global level.
- → Any transition scenario relying on the use of methane to produce or import hydrogen should carefully consider the impacts of methane leakage (upstream and downstream) when assessing compatibility with EU sustainability criteria.
- → Co-location of methane extraction and conversion/CCS processes can minimize leakage.
- → Methane leakage measurement and limitations are needed for hydrogen produced by methane and (decentralized) biomethane/biogas.

*note: this refers to intra-EU upstream emissions only. As the EU imports around 90% of fossil gas and oil used in Europe, overall upstream methane emissions are significantly larger.

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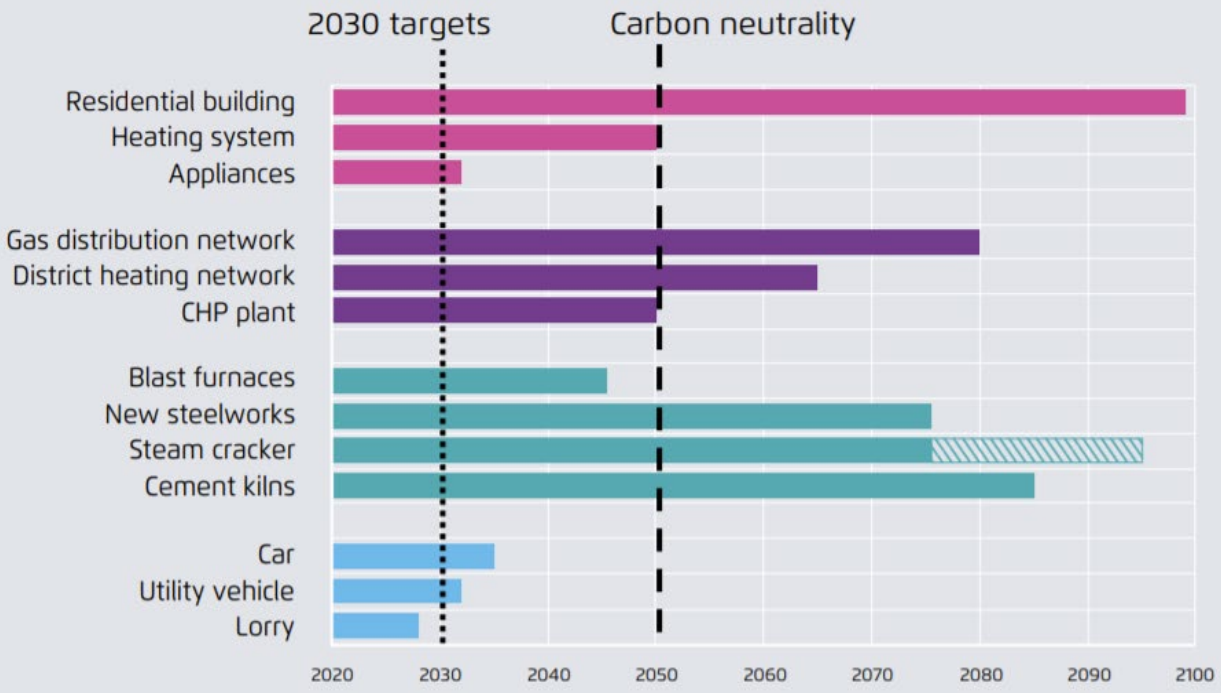
Policy Recommendations

Due to the long economic and technical lifetime of most fossil gas assets, strict regulatory measures must start immediately.

Technical lifetime of selected technologies if reinvestment takes place in 2020 — Figure 8

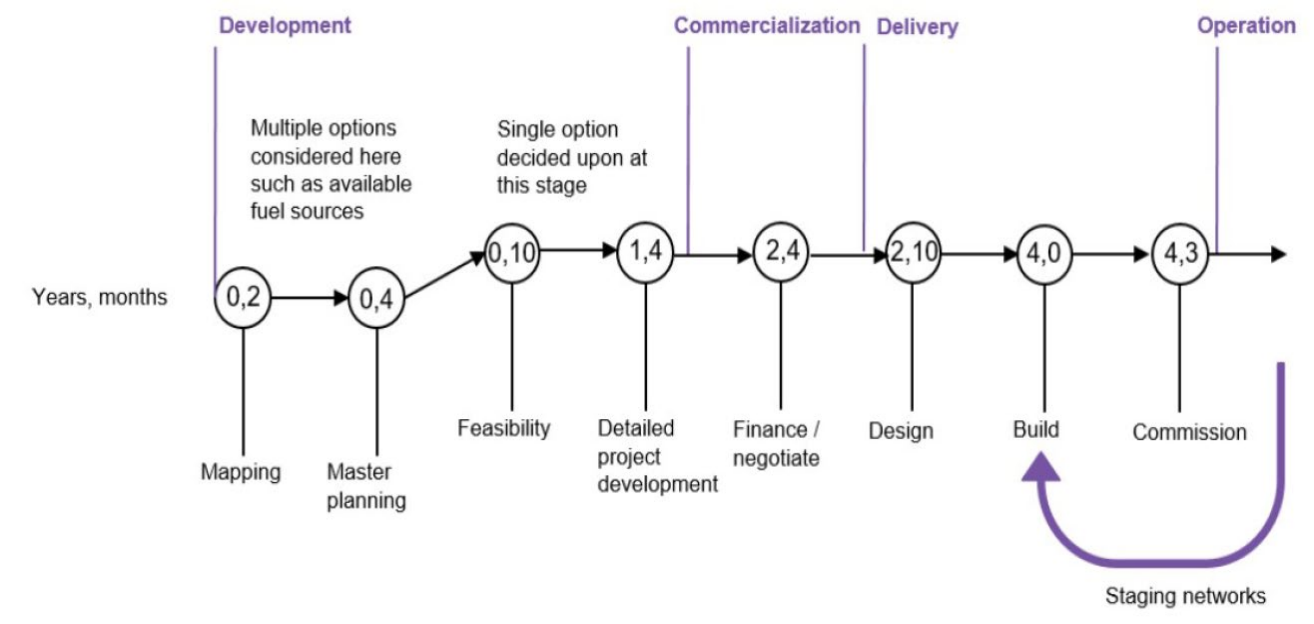


Based on Agora Energiewende (2019) and Agora Energiewende / Wuppertal Institute (2020)

- Unabated fossil gas use in buildings must largely come to an end by 2040. Nearly all existing fossil gas heating systems must have been replaced by this point in time.
- Many investments in the 2020-2030 decade will still be in use in 2040, some beyond 2050. Houses last 80–100 years; grids 50–60 years; gas boilers 15-20 years. Climate and energy policies must take these investment cycles into account to avoid stranded assets and expensive retrofits.
- EU legislation started addressing CO_2 emissions of cars, vans and parts of industry more than 15 years ago; progressively tightening standards. It is simply too late to apply such gradual approach to household heating systems. The sale of new fossil gas burning equipment should be stopped quickly.

Clean alternatives to fossil gas often come with long project lead-times and depend on related infrastructure development. Their deployment requires integrated, long-term planning.

Average timeline associated with district heat network development

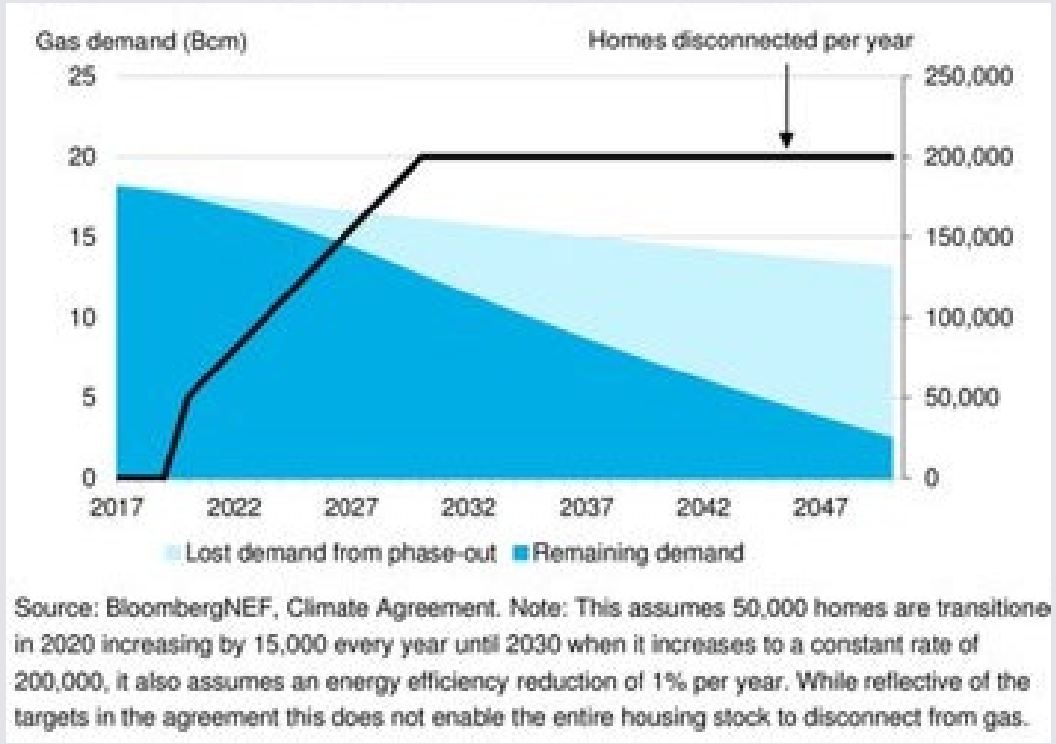


BNEF (2021): Financing Heat Networks in the UK Guidebook

- Integrated, long-term planning is essential to enable investments into clean alternatives to fossil gas and to ensure that manufacturing, construction and installation capacities keep up with the pace and scale of required investments.
- Integrated planning is particularly important for infrastructure development with long project lead-times (e.g., for new district heat networks) and also helps phasing the necessary construction works to avoid higher costs from multiple interventions at the same site.
- Integrated planning is also essential to identify the scale of investment needs and put in place adequate investment support schemes for households & businesses.

A new integrated planning framework is needed to phase-out fossil gas, with particular focus on infrastructure and buildings. The Dutch gas transition seems a useful model.

Rate of transition of households off gas, to achieve targets in Netherlands



Source: BloombergNEF, Climate Agreement. Note: This assumes 50,000 homes are transitione in 2020 increasing by 15,000 every year until 2030 when it increases to a constant rate of 200,000, it also assumes an energy efficiency reduction of 1% per year. While reflective of the targets in the agreement this does not enable the entire housing stock to disconnect from gas.

BNEF, Climate Agreement

Timeline of climate milestones announced in the climate agreement for buildings in Netherlands (according to BNEF):

- → 2019: climate accord announced
- → 2021: municipalities to announce their building decarbonization plans
- → 2023: review of the implementation of the plans
- → 2030: 1.5 million homes to be disconnected from the gas grid
- → 2030: local gas extraction ban takes effect
- → 2050: all homes now disconnected from the gas grid

Preparing for the necessary fossil gas phase-out in context of…

Energy Performance of Buildings Directive	
What do we need?	1. Establish a political target to phase-out unabated fossil gas from the building sector by 2045 and establish a requirement for Member States to plan the transition for phasing down fossil gas in buildings in line with this target and a shrinking fossil gas market, including integrating these considerations into their long-term renovation strategies (EPBD), their heating & cooling and RES assessments (RED/EED), National Social Climate Plans, NECPs, RRPs and "Net Zero Emissions Network Plans" (see Gas Directive/Regulation). 2. Set new rules to better harmonize the implementation of Energy Performance Certificates across the EU, in order to improve comparability and reliability and establish a new political target for the building stock as a whole in each Member State to achieve EPC class A/B by 2050. 3. Strengthen the definition of nearly Zero Energy Buildings applicable to new construction and explicitly prohibit the direct combustion of fossil fuels in all new buildings from entry into force. 4. Establish a new low-temperature readiness standard (LTR Standard) for existing buildings that defines the measures necessary to achieve a heating flow temperature below 55°C in order to enable the efficient operation of renewable heating systems. Establish minimum performance standards for all existing buildings that require them to meet the LTR standard by 2030. 5. Require building renovation passports to be introduced for all buildings and aligned to both the 2030 LTR standard and the long-term goal of EPC class A/B by 2050. 6. Require financial regulators to mandate a Mortgage Portfolio Standard aligned with the goal of EPC class A by 2050 as an approach to manage transition risk in real estate lending and EU mortgage portfolios. 7. Require Member States to design public renovation support schemes in the building sector that phase-out support for fossil fuels and provide clear incentives to do one-off deep renovations instead of staged ones.

Preparing for the necessary fossil gas phase-out in context of…

Ecodesign & Energy Labelling for Space & Water Heating Appliances	
What do we need?	1. Maintain the rescaling on Energy Labelling for space heating as foreseen in the draft regulation. 2. Revise the draft ecodesign regulation for space & water heaters so as to phase out the least-performing space heaters from 2025 (Efficiency <100% = <label E in the current draft regulation on Energy Labelling). 3. Apply the energy labels for space heating as an objective criteria for phasing out fossil boiler subsidies across Europe by introducing an immediate prohibition on subsidies for space heating applicances below the new label E, including in the context of EU funding, State Aid Guidelines and the European Semester.

F-Gas Regulation	
What do we need?	1. Introduce bans for high global warming potential heat pumps in the upcoming revision of the F-Gas Regulation in all applications where hydrofluorocarbon (HFC)–free alternatives already exist, including domestic ground-source heat pumps, water-source heat pumps, exhaust air heat pumps and monobloc air-source heat pumps. 2. Introduce an immediate ban for new switchgear containing Sulfer Hexafluoride (SF6) up to 145kV by 2025 and work towards a prospective ban of switchgear containing SF6 over 145kV between 2025 and 2030. Strengthen rules on monitoring, reporting and verification and producer responsibility for switchgear.

Preparing for the necessary fossil gas phase-out in context of…

Gas Directive & Regulation	
What do we need?	1. Replace the TYNDP with integrated "net zero emissions network plans" for gas, electricity, and hydrogen at EU and national levels to align network planning with the EU's 2050 climate-neutrality objective. These plans should take into account the need to prioritize the early take up of clean hydrogen in no-regret areas. 2. Introduce an obligation for all municipalities to develop local net zero network plans in line with the net zero emissions network plans with a view to decommissioning or repurposing local gas distribution grids. There should be a clear link to the sustainability for bioenergy assessment, as well as local heat plans. Require ENTSO-G to prepare for phasing down of fossil gas, in cooperation with all relevant stakeholders. 3. Introduce a requirement for DSOs/TSOs to remove infrastructure that will not be needed any longer at their own costs and to start building reserves for the removal. 4. Introduce a specific mandate for NRAs and ACER to pursue further market monitoring with regards to decreasing volumes on the internal fossil gas market and its consequences, including future increases in network fees for individual consumers and potential concerns over market power. 5. Expand scope of EU gas regulation from fossil gas to include hydrogen, biomethane, biogas, but make the introduction of an internal hydrogen market subject to higher hydrogen uptake (possibly post-2030). 6. Oblige industrial users to phase out fossil gas use for low temperature heat applications by 2030 (<200 °C). 7. Require full separation of fossil gas/methane and hydrogen grids and prohibit blending of hydrogen (exception for limited cases of local blending at DSO level where distribution grid is maintained). 8. Permit new fossil gas facilities only if compatible with net-zero, hydrogen ready and consistent with a carbon shadow price set in the EIB methodology and EU COM guidance; set a minimum capture rate for carbon capture and storage processes of 90% for retrofits of existing facilities and 98% of process CO_2 emissions for new/additional capacity as of 2025.

Preparing for the necessary fossil gas phase-out in context of…

Methane Leakage Regulation	
What do we need?	• Introduce an increasingly strict standard for fugitive and upstream methane emissions for domestic EU oil, gas and coal companies of 0.20% as of 2025 in line with the target set by Oil & Gas Climate initiative. • As of 2025 (delegated act) also introduce an increasingly strict standard for imported gas, with a view to achieving an average of 0.05% for both imported and domestic gas in the long run. • Require Member States to establish a competent authority responsible for monitoring and verification of meeting methane leakage standards and introduce requirements for oil, gas - including biogas/biomethane - and coal companies to regularly report towards this competent authority. • Establish a harmonized EU reporting framework for the data collected by the Member State competent authorities and give the European Commission a mandate to monitor and regularly report on progress. • Give a mandate to the European Commission to work in the context of the international methane emissions observatory to compile and publish a methane-supply index (MSI) at EU and international level. • Work in parallel to establish a robust methane leakage certification system for gas imports based on verified satellite data. • Failure to meet the standard should be associated with meaningful financial penalties, the revenues of which should support methane emission abatement investment costs.
Gas Security of Supply Regulation	
What do we need?	1. If the Regulation is opened as part of efforts to keep energy prices in check, the legislator should also address that the notion of "security of gas supply" must evolve over the coming years in context of a shrinking market. Measures to safeguard security of supply should be broadened to include long-term storage for hydrogen and heat as well as short-term incentives for reducing fossil gas demand.

Preparing for the necessary fossil gas phase-out in context of…

Climate, Energy and Environment State Aid Guidelines (CEEAG) and General Block Exemption Regulation (GBER)	
What do we need?	• Full application of the 'do no significant harm'-principle in state aid, full support to implementation of the Clean Energy for All Europeans-package and once available relevant provisions of the Fit for 55 package. • Enforce the long-standing commitment to phasing out fossil fuel subsidies through EU State Aid disciplines. • Specifically exclude blue hydrogen *production* from State Aid support, at least insofar as such production already benefits from free allowances under the EU ETS. • Immediate prohibition of support for space heating equipment below energy label E • Introduce specific provisions in the CEEAG or GBER with regards to support for decarbonization in the heat and industrial sectors where competitive price determination is not possible to accelerate state aid approval processes and avoid case-by-case notifications. • Member states must be allowed to tender renewable energies on a technology-specific basis without the need for justification – this for diversification and a balanced portfolio. • Oblige Member States to demonstrate that State Aid to scarce energy sources (bioenergy and hydrogen) is the most energy efficient decarbonisation option for the given usage to steer such resources only to high value uses, particularly in industry. • Make state aid for energy-intensive industries, including exemptions, conditional upon measures to invest into to more efficient and climate-neutral productions processes.

Necessary improvements to the July Fit for 55 Package

RED	• Stronger steering of the limited sustainable bioenergy and hydrogen potential to priority applications. More specific incentives to electrify heating and cooling. Capping/phase out of bioenergy in buildings. Requirements to introduce minimum renewables shares in building codes should be strengthened.
EED	• Proposed requirements for national and local heat planning should be strengthened. The EED could also be an appropriate place to introduce an integrated planning framework to phase-out fossil fuels beyond basic heat planning.
ETS-II	• The proposal does not foresee a price-cap and thus needs to be complemented by early action and strong EU-level measures to keep prices in check. A political target for the cap to reach zero by 2050 would complement the proposed EPBD target to phaseout unabated fossil gas use in buildings by 2045.
ETD	• Minimum energy pricing for heating should still be strengthened and complemented by a political target to reduce the gap between electricity and gas prices below a certain threshold.
Social Climate Fund	• National social climate plans should also take into account potential distributional impacts of a fossil gas phase-out on low-income and vulnerable households.

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Questions or comments? Feel free to contact us:

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What's in the July Fit-for-55 Package?

- EED Article 6 public bodies must renovate 3% of their building stock larger than 250m2;
- EED Article 8 increases energy savings obligations from 0.8% to 1.5% per annum from 2024;
- EED Article 24 requires new and renovated district heating/cooling networks to meet progressively stronger efficient district heating/cooling targets, including an increasing share of RES & waste heat;
- EED Article 23 requires Member States to undertake comprehensive heating & cooling assessments and encourage municipalities with more than 50.000 people to prepare local plans.
- RED Article 15 indicative target of at least a 49 % share of energy from renewable sources in the buildings sector; mandatory introduction of minimum RES shares in building regulations & codes.
- RED Article 23 binding target to increase RES in heating & cooling by 1.1%-1.5% per year and requirement to do an assessment of the RES and Waste Heat & Cold potential.
- RED Article 24 indicative target to increase RES and waste heat in district heating by 2.1% per year.
- The new ETS2 for buildings and transport would see an upstream system obligating fuel suppliers to purchase and surrender allowances from 2026 and setting a cap on emissions that will decline -43% by 2030 below 2005 levels. Price fluctuations are moderated through volume-based instruments.